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The Journal of Obstetrics and Gynæcology of the British Empire

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Sir Francis Henry Champneys, Bart., M.D.

Editor:
Eardley Holland, M.D.

with the co-operation of the following in respect of the places named; viz.

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John M. Munro Kerr, M.B., Glasgow.

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VOL. XXVII. MARCH—MAY, 1915. No. 3—5.

Presidential Address.

An Investigation of the Causes which Determine the Lie of the Fœtus in Utero.

By W. S. A. GRIFFITH, M.D.,

President of the Obstetrical Section of the Royal Society of Medicine, July, 1915.

THE problem of the causes determining the position of the fœtus in utero is one which has engaged the attention of investigators from early times, and has throughout led to much speculation on bases supposed to be correct but which being often wrong lead to wrong conclusions.

One of the most obvious and ancient of these errors which appears not to have yet quite died out is that the fœtus lies head upwards until the seventh month and then takes a dive and lies head downwards during the remainder of its stay in the uterus.

It was not until Onymos Smellie and William Hunter demonstrated the true facts of this fundamental matter that any real advance began to be made in its explanation.

Hunter says: "All the observations that I have been able to make in dissections and in the practice of midwifery would persuade me that the child's head is naturally downwards through all the later months of utero-gestation, and that neither reason nor instinct teaches it at a particular time any trick of a tumbler or rope-dancer."

Thomas Raynald in "The Byrthe of Mankynde," 1545, describes the position of the fœtus in utero (with an illustration plate) in the following terms in the last page of the first book: "In the last figure the chylde being a man chylde lyeth after the very manner as it is situat in the mother's womb, with the hed towardes the ryght angle or corner of the matrice, and the legges acrosse."

He, like some of us, has no respect whatever for the opinion of those who differ from him. He says: "Albeit there be that do

describe the lyeing of the childe after another sort, but to be short they are lyars."

He particularly says "a man chylde," and that it lies in the right side of the womb, for since Hippocrates taught it, it was believed that males lie in the right and females in the left half, and that a child in the middle must be an hermaphrodite.

This book which I exhibit is, as is well known, the first book printed in England with copper-plate engravings.

Mauriceau, 1682, writes: "The fœtus lies head upwards until the 7th or 8th month, then turns head downwards by a natural disposition of the weight of the upper parts of the body."

Hugh Chamberlen in his translation of this adds a footnote that "this movement is due rather to a natural propensity than to the weight of the head."

In 1743, Josephus Onymos, in an inaugural dissertation published by Haller in the fifth volume of his "Disputationum anatomicarum selectarum," p. 325, described with some accuracy the real position of the fœtus in utero and suggests, I believe for the first time, the gravity theory. Section V, translated from the somewhat ambiguous Latin, reads thus:—

"There exist, therefore, two properties which reside in the structure and conformation of the parts, namely, specific weight and volume. From these properties results the proper position of the fœtus, but these parts can be nothing else than the head, wherein no one will doubt these properties dwell. For it is evident that the head is the part which possesses the greatest volume, as mere inspection teaches us. So, too, as anatomical examination of its structure shows, the head has the greatest specific weight inasmuch as it is denser than the other parts, but where the density is greater there the weight is greater. For it is known from Physics that weights are proportionate to densities. We must now, therefore, enter on the further enquiry how the position (of the fœtus) results from these properties and what kind of position. We know, from Physics again, that if a body whose density and weight are not uniform throughout is placed in a sufficiently large vessel of fluid, the force wherewith it acts on the fluid is not uniform, so that that part of the body which is heavier than the other descends towards the centre of gravity with the greater force and speed. Now the head is the part which possesses the greatest volume and weight as compared with other parts, and the uterus is a sufficiently large receptacle, full of liquor amnii. Let the internal orifice of the uterus be the centre of gravity, and let the embryo in the uterus be regarded as the body which we have mentioned immersed in fluid; we shall see that the momentum of descent of its heavier part is in direct proportion to its weight, but the weight of its upper part, that is of the head, prevails over that of its lower

part, to which must be added its volume; so the head will necessarily move towards the centre of gravity with greater force and speed than the other end. Therefore the head of the fœtus will always occupy the lower part of the uterus."

His physics are not quite in accordance with our present knowledge, and he uses the term "centre of gravity" in a way which I do not understand, but it is clear that the idea underlying his statement is in the main correct.

It is not necessary, however, to spend our time in recalling the history of the various theories which have been advanced; they can be studied in the essay of Cohnstein, "Die Aetiologie der normalen Kindeslagen," *Monatsschrift f. Geburtshülfe u. Frauenkrankheiten*, vol. xxxi, 1868, p. 141.

Onymos in 1743 apparently originated the gravity theory and was supported in the 18th century by Levret, Fielding, Ould and Roederer. Gravitation, which as we shall see is the predominating factor, has been discussed since that time and has been accepted and rejected by many authors without an accurate knowledge of the factors which would either prove or disprove its importance.

Matthews Duncan strongly supported it, Sir J. T. Simpson as resolutely opposed it, and it has been a great pleasure to me while investigating the subject to find experimentally that many of the statements made by Duncan, based on theory and on crude experiment, were correct.

I therefore determined to investigate de novo the whole question, and I now place the results before you.

An important point necessary to be established was the frequency of the presence of the cephalic end of the fœtus at the lower or upper pole of the uterus during the later middle months of pregnancy.

The almost invariable presence of the cephalic end at the end of pregnancy in the lower pole is universally accepted and needs no independent investigation.

The position, however, in the middle months was one less certainly accepted, and I have made use of every opportunity afforded me to ascertain this point, and I am led to agree with Scanzoni, Veit, Dubois and others that in the middle months the proportion of head lowest positions of live fœtuses steadily increases from 50 per cent. before the 6th month to the almost invariably head lowest position as the mobility of the fœtus in utero decreases in the later middle months.

In the early months the embryo is small in proportion to its container and is freely movable within it; as pregnancy advances its mobility becomes more and more restricted as the size of the fœtus more closely approximates the size of its container; and we

may conclude that when this correspondence of size is being reached and the mobility of the fœtus is greatly restricted it is unlikely that any such great change of position as would be necessitated by a revolution of the fœtus could be accomplished without some extraneous agent such as is exampled by external version.

And this difficulty of movement, as we shall see later, is greatest when the "lie" is longitudinal, and especially so if the head is lowest, and even more if the head and the lower pole of the uterus lie comfortably in a pelvic brim of corresponding size.

We are fully justified in concluding that if a fœtus in the last three months lies head downwards in the lower pole of the uterus and in the pelvic brim, it is under ordinary normal conditions stable in this position and is very unlikely to alter, except as a result of rotation on its longitudinal axis, and that only to a minor extent.

The most important conditions which interfere with its stability are those which increase its mobility, such as hydramnion, and those which interfere with its presenting part lying comfortably in the lower pole of the uterus and in the pelvic brim, such as the presence of placenta prævia, fibroids in the lower uterine wall, solid or cystic tumours in the pelvis, some deformities of the pelvis, some deformities of the fœtal head such as hydrocephalus; great relaxation of the abdominal wall, allowing great mobility of the uterus, may also act in a similar way.

If the fœtal head does not lie in a brim adapted to its size it will be unstable and easily moved, and so-called transverse or oblique presentations are therefore commonly met with under these circumstances.

No other part of a fœtus is so adapted to the normal pelvis as the head; the breech when the presentation is "complete" rarely enters the brim until labour forces it in, though the "incomplete" breech may engage as firmly and with almost the stability of the head.

For the complete consideration of this problem it is necessary to ascertain certain physical properties of the fœtus at rest and of the liquor amnii and any forces which disturb the fœtus at rest.

(A) *The fœtus.*

The fœtus, which is a body of varying and not uniform density, is immersed in fluid in a closed cavity of more or less corresponding shape, and is for a time freely movable in it; later, as its size more nearly approximates that of the uterine cavity, its mobility is more and more restricted.

My investigations have been directed to the following points:

(1) The specific gravity of the fœtus at different periods of development and of its most important parts.

(2) The specific gravity of hydrocephalic and anencephalic fœtuses, and especially of the head in these cases.

(3) The centre of gravity of the fœtus.

(B) *The liquor amnii.*

This is a fluid of uniform density in each specimen.

(4) We must consider the varying specific gravity of different specimens.

(5) The relative specific gravity of the fœtus and the liquor amnii.

(6) The metacentre or centre of buoyancy. This is the centre of gravity of the fluid displaced by the fœtus, *i.e.*, the centre of gravity of a substance of uniform density exactly corresponding in shape and size with the fœtus. It is the centre through which the resistance to the descent of the fœtus, whatever its position in utero, must act in a vertical direction.

(7) The relative positions of the centre of gravity of the fœtus and the metacentre.

(C) *Movements disturbing the fœtus at rest.*

(8) Fœtal movements.

(9) Uterine movements, *i.e.*, contractions.

(10) Maternal movements.

In order to illustrate the importance of the specific gravity of the fœtus in relation to this question, let me refer to the chief points in the discussion between Matthews Duncan and Sir J. Y. Simpson.

Sir James Simpson had tried to show that the *chief* factor in determining the position of the fœtus was the obovoid shape of the cavity of the uterus acquired during the development of pregnancy, and that the fœtus adapted itself to this shape so as to lie in the most comfortable position.

Dr. Duncan's view was that the shape of the uterine cavity was principally determined by the shape of its contents, and that gravitation was the essential factor in determining the position of the fœtus.

Simpson said: "Most authorities have supposed that the position of the fœtus in utero with the head undermost was owing to the greater specific gravity of the head," and that if this were so "this position ought to be found with more frequency and certainty when the gravitation of the head from any cause was rendered proportionately greater than natural; with less frequency and certainty when the gravitation of the head was rendered proportionally less than natural." The very contrary of this (he said) is however the truth. "In cases of intra-uterine hydrocephalus, the child's head is larger and heavier than usual. . . . But this condition of the head, this increased preponderance and gravitation

of it, does not render head presentations in these cases more common than usual, but the very reverse. Again, anencephalic fœtuses with the whole brain and arch of the cranium wanting are still often found presenting naturally."

Dr. Duncan replied thus: "Now this argument when justly applied is made to tell most decidedly in favour of the gravitation theory. The altered circumstances of a hydrocephalic fœtus have been altogether misapprehended. The hydrocephalic head, although truly much larger and heavier in air, is *probably* lighter and more buoyant in water. In this way it is demonstrated that the four times greater frequency of abnormal presentations in cases of hydrocephalus proves rather than disproves the influence of gravitation in deciding the position of the fœtus."

With regard to anencephalous fœtuses he hints at the probable error in the argument, but says "we can base no reasonings upon the presentations of anencephalous fœtuses whose statical conditions we do not know."

It will be seen from these very short abstracts what an important bearing on the question the specific gravity of the fœtus as a whole and of its chief parts has had in the discussion of this question, and how important it is that this should be determined.

Duncan's theory in both cases was correct, as these experiments prove, the anencephalic head has a very high, the well-marked hydrocephalic head a very low, specific gravity.

I have investigated the specific gravity of 60 fœtuses which include examples of each month from the 2nd onwards. Seven of these showed early or advanced maceration. All the rest were fresh fœtuses without any evidence of having died before labour began. A few, however, of these had to be rejected on account of air having entered the lungs in small quantity, or the stomach and intestines in large quantity, as the result of attempts at artificial respiration. This condition was usually suspected by finding a low specific gravity and proved afterwards by examination of the viscera.

The omission of this precaution renders the experiments, and any conclusion drawn from them, valueless. An interesting paper recently published by Dr. Charles G. Barnum, of Groton, Connecticut, in the *Journal of the Americal Medical Association*, February 6th, 1915, p. 498, loses some of its value on this account.

The specific gravity of the fœtus and its different parts was calculated from the difference of weight in air and in water, great care being taken to avoid error from the admission of air into the fœtus and adhesion of air bubbles to the surface when immersed in water. The difficulty of avoiding error was greater when the fœtus was divided for the purpose of ascertaining the specific gravity of its constituent parts. The difference between the head and the rest of the body was ascertained in every case.

TABLE I.

The Specific Gravity of the Fœtus at Different Periods of Development.

Reference Number and Weight.	Presentation, Sex.	Notes.	Whole Body.	Head.	Thoracic and Abdominal Portion.	Thoracic Portion.	Abdominal Portion.
2nd Month.							
1. 174 grs.			1.032	1.029	1.035		
3rd Month.							
2. 2½oz.	Female.		1.036	1.033	1.038		
4th Month.							
3. 2¾oz.	Male.		1.037	1.030	1.040		
4. 4¼oz.	Female.		1.049	1.046	1.052		
5. 4½oz.	Male.		1.040	1.036	1.043		
6. 4oz.	Male.	R. arm 1.037 R. leg 1.036	1.035	1.031	1.037	1.038	1.036
5th Month.							
7. 11oz.	Breech. Male.		1.042	1.037	1.045		
8. 9½oz.	Not known. Female.		1.043	1.036	1.046	1.045	1.048
6th Month.							
9. 2lb. 2oz.	Head. Female.	Twins.	1.050	1.050	1.050	1.050	1.049
10. 1lb. 12½oz.	Breech. Female.	Twins.	1.049	1.048	1.050	1.049	1.051
11. 1lb. 9½oz.	Breech. Male.	Hydramnion. Umbilical cord, 1.020.	1.046	1.044	1.049		
12. 1lb. 3oz.	Breech. Male.		1.051	1.047	1.056		
13. 1¾lb.	Breech. Female.	Maceration begun.	1.050	1.048	1.053		
14. 2lb. 5¾oz.	Head & left shoulder.		1.050	1.049	1.055		
7th Month.							
15. 2¾lb.	Head Female.		1.050	1.047	1.052	1.055	1.0499
16. 3¼lb.	Breech. Female.		1.054	1.051	1.056		
17. 1¾lb.	Breech. Female.		1.053	1.045	1.057		
18. 3¾lb.	Breech. Male.	R. arm 1.045 R. leg 1.049	1.052	1.053	1.051	1.053	1.049
19. 3¼lb.	Not known. Female.		1.050	1.044	1.054		
20. 2¼lb.	Not known. Male.		1.044	1.044	1.045		
21. 2½lb.	Not known. Female.	One of triplets.	1.051	1.047	1.053	1.054	1.051

Reference Number and Weight.	Presentation. Sex.	Notes.	Whole Body.	Head.	Thoracic and Abdominal Portion.	Thoracic Portion.	Abdominal Portion.
22. 3¼lb.	Uncertain. Male.	Maceration begun.	1.058	1.060	1.057		
23. 2½lb.	Head. Female	Anencephalus	1.050	1.061	1.049		
8th Month.							
24. 4½lb.	Head. Female.		1.051	1.046	1.053	1.054	1.052
25. 3½lb.	Head. Male.	Maceration begun.	1.052	1.051	1.053		
9th Month.							
26. 8½lb.	Vertex. Male.		1.052	1.055	1.051		
27. 9¾lb.	Vertex. Male.		1.050	1.056	1.048		
28. 5¼lb.	Vertex. Male.		1.055	1.056	1.054		
29. 5¾lb.	Vertex. Female.	Twins.	1.056	1.065	1.053		
30. 4¼lb.	Vertex. Female.		1.055	1.060	1.054		
31 6¾lb.	Vertex. Female.		1.055	1.059	1.053		
32. 7¼lb.	Vertex. Female.		1.054	1.058	1.053		
33. 5¾lb.	Vertex. Male.		1.059	1.059	1.059		
34. 7¼lb.	Vertex.	L. arm 1.055 L. leg 1.051	1.052	1.050	1.053	1.055	1.051
35. 6lb.	Vertex. Female.		1.052	1.054	1.048	1.048	1.047
36. 5¾lb.	Vertex. Female.		1.050	1.058	1.048	1.051	1.044
37. 7lb.	Vertex. Male.	R. arm. 1.060 R. leg 1.058	1.060	1.066	1.058	1.058	1.056
38. 4¾lb.	Breech. Female.		1.049	1.046	1.050		
39. 8½lb.	Breech. Male.		1.059	1.063	1.054	1.056	1.051
40. 5½lb.	Right shoulder. Male.		1.059	1.059	1.059		
41. 5¼lb.	Shoulder. Male.		1.049	1.054	1.045	1.047	1.044
42. 6¾lb.	Vertex. Male.	Maceration advanced.	1.049	1.050	1.048		
43. 5lb.	? Vertex. Male.		1.046	1.048	1.045		
44. 4¾lb.	Vertex.	Maceration begun.	1.055	1.060	1.054		
Hydrocephalus.							
45. 8¾lb.	Vertex. Male.		1.042	1.038	1.044		
46. 7¼lb.	Vertex. Female.		1.049	1.037	1.059	1.061	1.057

A considerable number of fœtuses were divided into three portions : (1) the head ; (2) the thorax and arms, including the liver and spleen, which in a fœtus that has not breathed are entirely covered by the lower part of the thorax ; (3) the abdomen and legs.

Table (I.) gives the details of 46 specimens selected for their accuracy.

They show a steady rise in specific gravity as the fœtus develops, and this appears to be largely due to the progress in development of bone, and the amount of bone in the different parts.

The smallest embryo (No. 1) weighed 174.1 grains, and was expelled at the end of the 7th week after the last menstrual period. Ossification had commenced in the ribs, long bones, lower maxilla and clavicle. Its specific gravity was 1.032.

The largest (No. 27) weighed $9\frac{3}{4}$ lbs., and its specific gravity was 1.050.

The tables are arranged according to the month of pregnancy so far as this could be ascertained, chiefly from the menstrual history, in a few cases by the development of the body.

I have included in the tables the sex and the presentation of the fœtus where this was certainly known.

The small fœtuses of the first four months are so movable that it is often not possible to be sure how they lie and present in the lower uterine segment.

In the two of the fifth month one presented by the breech ; the other was not known.

In the sixth month three presented by the head, four by the breech, and one by the head and left shoulder.

I have omitted from some of the tables a considerable part of the details which I have accumulated as being now unnecessary and only of value to any who are interested in studying the rival theories of past writers. When I began this investigation I was under the impression that the determination of the specific gravity of the fœtus and its parts would give us the answer to the problem. The few points I will draw your attention to will demonstrate that this is not the case.

These are (1) that in no instance does the specific gravity of the head exceed that of the remainder of the body before the end of the sixth month. It is generally lower, and in only one case of the sixth month was it equal to that of the body.

In three only out of nine normal fœtuses of the seventh month was the specific gravity of the head higher than that of the body.

In two of the eighth month, the only ones I have examined of this month, the specific gravity of the head was lower than that of the rest of the body.

In sixteen full-term fœtuses the specific gravity of the head was considerably higher than the body in 13, equal in 2, lower in 1.

It will also be noted that up to the end of the sixth month of pregnancy the difference of specific gravity of the three great divisions of the fœtus, namely its head, thorax with the arms, abdomen with the legs, is very slight. During the seventh and eighth months the thoracic portion is the highest, and it is only in the last month that the head is constantly higher than the rest of the body.

It is also clearly seen that the relative specific gravity of the head to the body has no necessary relation to the lie of the fœtus, whether when quite fresh or in various degrees of maceration in utero, and contrary to theory maceration hardly affects the specific gravity of the fœtus.

Two other matters of interest are demonstrated in these tables, matters which were of much importance in the rival contentions of Matthews Duncan and Sir J. Y. Simpson. The examination of hydrocephalic and anencephalic fœtuses show that the theoretical opinion and arguments of Matthews Duncan were correct.

The specific gravity of the two hydrocephalic fœtal heads is very low, as low as in normal fœtuses of the 5th month, namely, (45) 1.037, (46), 1.039.

The head of the anencephalous fœtus of the 7th month (23) was very high for the period of development, namely, 1.061. It consists chiefly of bone.

The specific gravity of full-term normal male fœtuses varies between 1.049 to 1.060, of females between 1.049—1.056, the average in 9 males 1.055, in 7 females 1.053.

The specific gravity of the umbilical cord is 1.020, considerably higher than that of the liquor amnii, and it therefore sinks when lying free in it.

The specific gravity of the liquor amnii.

The present series comprises 112 specimens, of which 8 were specially examined immediately after evacuation, as well as when cold, to show the difference in specific gravity under these conditions; the remainder were taken when cold, and were recorded with the age of the mother, the number and duration of the pregnancy, and the sex, length, and weight of the infant, none of which conditions, however, appear to have any influence on the matter.

The table shows that the limits of variations are less than those usually given, the average being 1.007, which agrees with that usually accepted.

Spiegelberg gives the variations as between 1.002 and 1.028, and Whitridge Williams, like many recent writers, gives the same figures. The limits in this series are 1.002 to 1.016, but it will be seen that in the three instances in which the specific gravity exceeded 1.012 there was evidence of some abnormal condition, in

two it was of a dark green colour and probably contained meconium, and in the other case the fœtus was macerated, though there are, however, two others containing meconium and one from a macerated fœtus which have a specific gravity nearer the average.

This series does not contain any specimens from early pregnancies, but instances recorded by other observers make it probable that there is little variation at the different periods of pregnancy. The large majority on this series are of the 9th month, a few only of the 7th and 8th month.

TABLE II.

In 3	cases	the	specific gravity	was 1.002.
,, 1	,,	,,	,,	1.003.
,, 19	,,	,,	,,	1.004.
,, 2	,,	,,	,,	1.005.
,, 44	,,	,,	,,	1.006.
,, 16	,,	,,	,,	1.008.
,, 1	,,	,,	,,	1.009.
,, 19	,,	,,	,,	1.010.
,, 4	,,	,,	,,	1.012.
,, 2	,,	,,	,,	1.014.
,, 1	,,	,,	,,	1.016.
112				

The complete tables, which I do not exhibit, appear to show that the specific gravity of the liquor amnii is independent of the sex weight and length of the fœtus and of the age of the mother and the number of her pregnancies.

TABLE III.

Specific Gravity of Liquor Amnii at Full Term.

	At body temperature.	When cold.
1.	1.000	1.002.
2.	1.002	1.004.
3.	1.002	1.006.
4.	1.002	1.006.
5.	1.002	1.006.
6.	1.002	1.006.
7.	1.002	1.006.
8.	1.006	1.010.

This table shows the low specific gravity of the liquor amnii at the body temperature.

A comparison of the specific gravities of fœtuses and liquor

amnii shows an increasing preponderance of that of the fœtus throughout pregnancy, and the fœtus must therefore always sink to the most dependant part of the uterus.

Fœtal movements.

These are of two kinds, passive and active. The passive movements of the fœtus are due to its weight and to changes of posture of the mother such as from standing to sitting or when lying on the back or changing from one side to the other, in which the greater specific weight of the fœtus causes it to sink to the most dependant part of the uterus.

While the fœtus is small, or when there is a great quantity of liquor amnii, the effect of such movements, as of all others affecting the fœtus, may be of importance, but when the mobility of the fœtus is restrained the effect must be limited more and more and can at most effect a change laterally as from a first to a second position.

In considering the question of the effects of factors which disturb the fœtus at rest, it is interesting to realise the very small effective weight of the fœtus immersed in liquor amnii of the average specific gravity.

This I have ascertained, and find that 7 ounces represent the effective weight of a full-term fœtus of 7—8 lb. weight in liquor amnii of the average specific gravity as it sinks to and rests on the most dependant part of its containing cavity, of which weight about one-third is contributed by the head and two-thirds by the body of the fœtus. The weight of the body may be taken as accurately representing the gentle pressure which maintains the flexion of the fœtal head on the body when the head is lowest, and the weight of the head as representing the still more gentle pressure of flexion where the breech is lowest. This gentle pressure is not augmented until the contractions of the uterus in labour cause a greatly increased pressure on the fœtus and on the passage from the uterus which has to be dilated for the extrusion of the fœtus.

Active movements of the fœtus.

These are the movements of the limbs which are often of a sudden and jerky nature; the gentle sliding movements can hardly be of importance as causes of disturbance of the position of the fœtus. Movements of the arms are of less importance than those of the more powerful legs which being attached to one pole of the fœtus may under certain circumstances cause movement of the whole fœtal body.

When the fœtus kicks, its foot or knee strikes the uterus, which is generally flaccid and yields to the pressure, and there will be little movement of the fœtal body. External to the uterus the

abdominal walls and contents are for the most part elastic and, as we often see, yield to the pressure of the limbs, but at the lower pole the pelvic brim offers a firm resistance, and movement of the fœtus would be probable if it is freely movable and if the breech presents and the fœtus can kick its mother's pelvis.

If, however, as is usually the case, the breech lies in the upper pole and the fœtus is only able to kick the elastic structure between the fundus and the diaphragm, and if in addition the fœtus is not freely movable, the effects of the fœtal movements on its body would be slight and of little importance, and I may repeat the statement that if a fœtus of a size nearly corresponding to that of its container lies with the head in the lower pole of the uterus, and both lie comfortably in the pelvic brim, it is in a condition of stability from which it is not easily disturbed.

On the other hand, if a fœtus, owing to its free mobility or from any of the causes previously mentioned, lies in an oblique or other position above the brim, its position is not stable and may vary as the result of its own movements, or of movements communicated to it by the varying positions of the mother.

Movement due to uterine contraction.

Contractions of the pregnant uterus are so commonly observed that if they produced any marked change in the position of the fœtus their effect would be well known. I have never seen any such effect, nor do I know of any evidence in favour of it. When the fœtus and uterus approximate in size, their long axes correspond in direction, and it is probable that in the event of their not doing so the contractions of the container would tend to redress any considerable diversity but would have little or no effect in the determining which end of the long axis of the fœtus occupies the upper or lower pole of the uterus.

We are therefore probably justified in concluding that the cumulative effects of the natural forces which disturb the fœtus at rest can only act as assistants in adapting the long axis of the fœtus to its container, and while it is freely movable to enable the only dominant and always present force, namely gravity, to act efficiently until the position has become stable. We know of no natural factor capable of disturbing it when once this is attained, and if such a change of position is desired we have to employ external version, and even then we are not always able to accomplish it.

The centre of gravity of the fœtus and the metacentre.

This aspect of the problem was suggested to me recently when making enquiries about the methods used by designers for ascertaining the buoyancy and stability of boats and vessels of all kinds

on or in water, and with the invaluable assistance of Dr. Womack, Lecturer on Physics at St. Bartholomew's Hospital, I have been able to carry out some experiments to determine these points.

While the principle involved is a simple one, the determination of the centre of gravity of the fœtus with sufficient accuracy is not difficult, but the determination of the metacentre involves technical difficulties which can only be overcome by experience and with the aid of an expert in making casts and in modelling.

It is this part of the question which has necessitated so much delay on my part in bringing this problem before you.

The centre of gravity I worked at years ago, and the results are interesting as far as they go, but the problem is to be determined by ascertaining the relative positions of the centre and metacentre or centre of buoyancy.

The stability or buoyancy of a boat or any vessel intended to float (see Diagram I.) is determined first by ascertaining the centre of gravity (G) of the boat, that is the point through which in any position of the boat its weight (W) would tend to sink it; secondly, to find the metacentre or centre of buoyancy (M), that is the point through which the vertical upthrust (F) of the supporting fluid must act in any position of the boat. This point corresponds with the centre of gravity of any body of uniform density and of precisely the same shape and size as the portion of the boat which is submerged.

These two forces, the weight and resistance, are necessarily equal, and if the centres through which they act coincide, the floating body, unless disturbed by some other agency, would remain at rest in any position in which it is placed.

If the centres do not coincide, but are at some distance from each other, and there is no extraneous force to complicate matters, the couple thus formed would tend to rotate the boat until it comes to a position of rest with the centre of gravity vertically below the metacentre, causing it to return to its upright position or, if the position of the centres is reversed, causing it to capsize.

If this principle is applied to the fœtus immersed in fluid (Figure II.) owing to its weight being greater than an equal quantity of liquor amnii it must be brought to rest by the resistance of the uterine wall plus the upward thrust of the surrounding liquor amnii, the weight (W) of the fœtus acting through its centre of gravity (G), the resistance (F) through the centre of gravity of the displaced fluid, *i.e.*, the metacentre (M), it must follow that if the two centres do not coincide the fœtus can only be brought to rest when its centre of gravity lies vertically below the centre of buoyancy.

The centres cannot coincide, the liquor amnii is of uniform density, the fœtus is not, so that if the centre of gravity of the

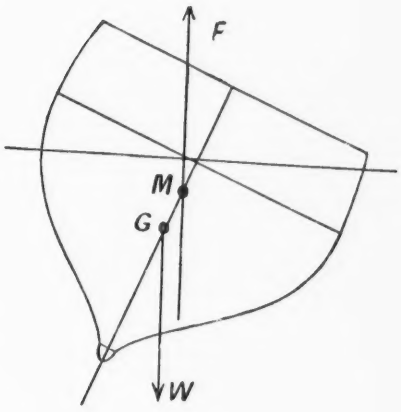

FIG. I.

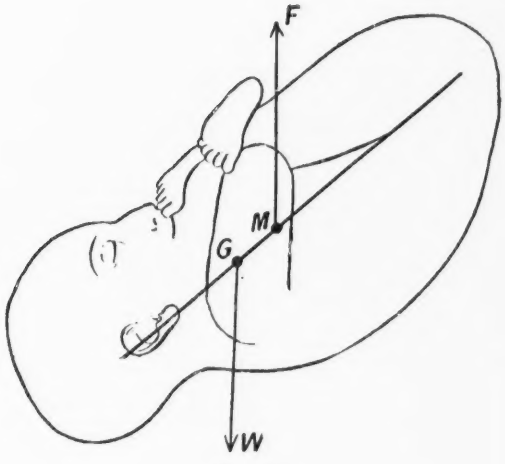

FIG. II.

fœtus is nearer the head end of the axis of the fœtus than the centre of buoyancy, the head end if free to move must tend to sink to the most dependant part. This tendency will be aided by all movements which disturb the fœtus at rest to which I have referred.

The instrument used in my earlier experiments for determining the position of the centre of gravity was made for me by the Cambridge Scientific Instrument Company.

It consisted of a rectangular table of hard wood perfectly balanced on knife edges, a line is marked on the table uniting the knife edges on which it is supported. This table, though made for large fœtuses, was found to be reliable for embryos of the early months.

A fœtus tied up by thread in the attitude usual in utero is laid on the table and adjusted until perfectly balanced; the centre of gravity lies in the vertical plane of the fœtus resting on the line joining the knife edges. This plane is marked on the fœtus.

In order to determine the position of the centre of gravity in this plane two other intersecting planes are ascertained by shifting the fœtus and then marking them in the same way.

Long steel needles are then passed through the fœtus in these planes and the point of intersection taken as representing the centre of gravity. This point was without exception close to the upper surface of the diaphragm, at the spot where the inferior vena cava enters the right auricle.

Some details are given of 14 fœtuses of the 4th and succeeding months, and show the distance of the centre from the vertex and the breech, and in some instances the point of intersection of the needles (see Table IV).

TABLE IV.

Centre of Gravity in 14 fœtuses from the 4th month onwards.

M.=male, F.=female, B.=breech, V.=vertex.

The length of a fœtus is measured in inches from vertex to breech.

1. Fourth month, M., length 3.5″, C. of G. is 1.5″ from V., 2″ from B.
2. Early 5th month, F., length 6.5″, C. of G. is 3.25″ from V., 3.25″ from B.
3. Early 5th month, F., length 5.5″, C. of G. is 2.6″ from V., 2.9″ from B.
4. End of 5th month, M., length 7.3″, C. of G. is 3.7″ from V., 3.6″ from B. (head presentation).
5. End of 5th month, F., length 7.1″, C. of G. is 3.5″ from V., 3.6″ from B. (needles cross in pericardium on the anterior surface of right auricle).

6. End of 6th month, F., length 8.25″, C. of G. is 4.125″ from V., 4.125″ from B.
7. End of 7th month, F., length 12″ (breech presentation) (needles cross within pericardium close to right auricle).
8. Middle 8th month, M., length 11.4″, C. of G. is 6″ from V., 5.4″ from B. (head presentation).
9. Middle of 8th month, F., length 11.1″, C. of G. is 6.5″ from V., 4.8″ from B. (vertex presentation) (artificial respiration, partial inflation of lungs and corresponding descent of heart and liver).
10. Early 9th month, M., length 11.25″, C. of G. is 6″ from V., 5.25″ from B.
11. End of 9th month, length 13″, C. of G. is 7″ from V., 6″ from B. (needles cross in pericardium close to right auricle).
12. End of 9th month, F., length 13.2″, C. of G. is 7.2″ from V., 6″ from B. (needles cross in pericardium close to right auricle).
13. End of 9th month, M., length 12.4″, C. of G. is 6.7″ from V., 5.7″ from B. (vertex presentation).
14. End of 9th month, M., length 13″, C. of G. is 6.6″ from V., 6.4″ from B. (breech presentation).

From this table it will be seen that the centre of gravity is nearer the head than the breech in the specimen of the 4th month only, in the five specimens of the 5th and 6th month it is practically midway, and in seven specimens of the 8th and 9th months it is nearer the breech end.

This gradual displacement of the centre of gravity towards the breech end of the fœtus is apparent, not real, for it will be remembered that in every case tested in this respect the intersecting needles meet at the point where the inferior vena cava enters the heart, so that there is no variation in the position of the centre of gravity in relation to this part of the body: it appears to be constant, but owing to a greater elongation of the cephalo-thoracic portion than of the abdominal portion of the fœtus the distance from the extremities of the long axis varies, and this causes an apparent displacement.

Recent writers have noticed the apparent displacement and have accepted it as real, and so far as I know no actual determination of this point has previously been made.

I draw attention to No. 9 in the series, where the centre of gravity was found to be 6.5 inches from the vertex and only 4.5 from the breech, a difference so great as to throw doubt on the accuracy of the result.

On referring to my original note and drawing of the fœtus, I find it stated that prolonged artificial respiration was carried out,

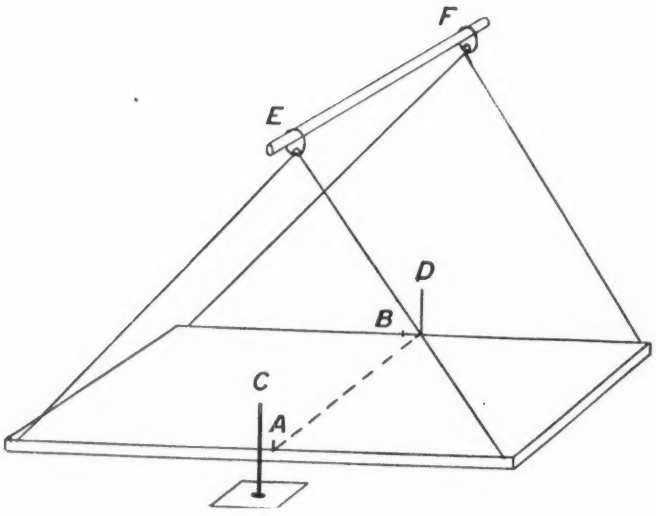

FIG. III.

that the lungs were partially inflated, and thus the liver and heart were displaced downwards from their usual positions in the thorax, and thus accounted for the displacement of the centre of gravity. I have, however, retained the record in the table.

The later experiments to ascertain the relative positions of the centre of gravity and metacentre were carried out on a balance designed for me by Dr. Womack (Diagram III).

It consists of a horizontal table suspended by four strings passing from its corners to the rod EF.

A line AB across the table, lying vertically below EF, is sighted by means of two uprights A and B, which are arranged in alignment.

The fœtus in the usual intra-uterine attitude, or its replica in wax, is placed on the table and adjusted until the lines A, B, C and D are exactly in alignment. Then the centre of gravity will lie in the vertical plane AB, EF. This plane is marked on the fœtus and the distance measured from this line to the two extremities of the fœtus, vertex and breech.

These measurements record the position of the centre of gravity of the fœtus in relation to its long axis.

The metacentre was then obtained by making a plaster of Paris mould and a wax cast of the fœtus in exactly the same position and attitude and finding its centre of gravity.

Our early attempts were only partially successful owing to the complicated form of the fœtus, due especially to its folded arms and legs, but I was fortunate in obtaining the assistance of Mr. Fossick, an expert artist in modelling and making casts. He made a mould which could easily be taken to pieces for the removal of the fœtus, and when placed together again enabled him to make an accurate cast in wax of the fœtus.

The two casts I exhibit were made in the physical laboratory at St. Bartholomew's Hospital, one in paraffin by ourselves, and one in a wax mixture made by Mr. Fossick.

The wax casts represent accurately the fœtuses in size and contour, and therefore represent the liquor amnii as displaced by the fœtus in utero, and unlike the fœtus but like the liquor amnii they are of uniform density.

The centre of gravity of the cast, therefore, represents the centre of gravity of the displaced liquor amnii and is the required centre of buoyancy or the metacentre.

In both these full-time fresh fœtuses the metacentre lies 5 mm. nearer the breech end of the fœtal axis than the centre of gravity, and so far the problem is solved.

TABLE V.

Relative Position of Centre of Gravity and Metacentre.

1. Middle 9th month, M., 2954 grms., length 30.5 centimetres.
   C. of G. is 16.3 centimetres from Vertex, 14.2 centimetres from Breech.
   8 cmm. from nearest point on dorsal margin.
   4 cmm. from nearest point on ventral margin.
   Metacentre is .5 cmm. nearer Breech; effective weight 184 grms.
2. 9th month, F., post-mortem Cæsarean section. No moulding of head. Length 31.5 cmm., weight 2500 grms.
   C. of G. is 16 cmm. from Vertex, 15.5 cmm. from Breech.
   Metacentre is .5 cmm. nearer Breech; effective weight 156 grms.

It may be of interest to add, in respect of the purely mechanical questions raised in the paper, a few remarks on the magnitude of the forces which come into operation, which Dr. Womack contributes.

"The fœtus, No. 1, Table V, weighing in air 2950 grms., weight in liquor amnii about 184, the upthrust of the fluid is *2766* grms. Supposing the fœtus first placed with its long axis horizontal, there would thus be a pair of forces each of 2766 grms. acting at a distance of 0.5 cm. from one another. This constitutes a 'couple' whose 'moment' is 2766×0.5, or *1383 centimetre-grammes*.

"As the fœtus changes position this 'moment' diminishes (as it does in most mechanical problems, *e.g.*, the movement of a pendulum, or the closing of a door), but allowing for this, if the rotation of the fœtus were unresisted by friction with the liquor amnii or by the passive resistance of the uterine wall, it would result in the fœtus rotating into the vertical position in so short a time as one-third of a second approximately.

"When in liquor amnii the couple acting on the fœtus is still the same, but owing to fluid friction the rotator motion would be slower and uniform. It is, however, not possible to calculate with certainty the time of rotation through 90″, but judging from similar problems met with in hydrodynamics the time required would be approximately 65 seconds.

"No such rapid rotation is to be expected; the figures are merely given to illustrate the magnitude of the purely mechanical effects if the resistance of the uterine wall is ignored. But the continued action of the couple, always in the same direction, though slow of effect would be favoured by the intermittent contraction of the uterine wall, the movements of the fœtus and of the mother."

In order to complete this investigation, it is necessary to ascertain the relative position of the centre in fœtuses of the earlier months. This I intend to do and to bring the results before the Section at a later period.

In this paper I have avoided criticism of the views of others, for I venture to think that the systematic experimental work which I have done will be of more value than criticism, and will for the future help to remove much speculation and many sources of error on which so much that has been written on this subject has been based.

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The Prevalence of Congenital Syphilis amongst the Newly Born of the East End of London.*

By Paul Fildes, M.B., B.C. (Cantab.).

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Introduction.

The object of this investigation was to determine the incidence of syphilis in infants as a result of a congenital infection. For this purpose it was arranged to perform the Wassermann test upon a random sample of 1,000 infants at birth, and again upon the same infants and their mothers at a certain period after birth.

The grounds upon which this plan of action was adopted may be discussed shortly. Firstly, it should be understood that the factors governing the birth of a healthy or syphilitic infant by a syphilitic woman are not yet satisfactorily established. When a syphilitic baby is born, the fact of its infection is not necessarily apparent from inspection of the child at birth, neither does the disease necessarily become manifest in the first weeks of life; indeed, it has been suggested that an infant may develop into a child and escape all outward evidence of disease until years have elapsed from the time of birth. Under such circumstances it might be questioned whether an examination in infancy, however searching and elaborate, would be of much value in throwing light upon the incidence of congenital syphilis in the offspring of syphilitic parents.

For the purposes of an inquiry such as the present it is obviously necessary to fix an arbitrary age at which the observation of an infant must cease, and since this age must not exceed at most a few months, it is clearly possible that the disease may develop after the infant has been classed as free.

Such an objection may justly be based upon the published views of competent observers, but on the other hand it must clearly be understood that when syphilis is alleged to arise at the age, for instance, of eight years for the first time, reference is only made to the appearance of outward manifestations and not to the subtle changes which are capable of detection by modern methods. Thus it appears highly improbable that an infant should be born infected with syphilis and yet not develop a positive Wassermann reaction for years or even months after its birth. If such an event were

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possible it would imply that the virus of syphilis—the *Spirochæta pallida*—was capable of maintaining itself in the infant's body from the time of birth onwards for months or years without inducing the slightest reaction on the part of that infant, since if a reaction existed it would be detectable by the Wassermann test. Such an eventuality, unsupported as it is by direct evidence or even analogy, may be safely dismissed or, at least, looked upon as a very rare phenomenon. This investigation, therefore, has been carried out on the assumption that if an infant, when born, is infected with syphilis, it will respond to the infection by the development of the diagnostic serum reaction, even though it may show at the time no manifestations capable of detection by careful physical examination. This phenomenon of so-called " latent syphilis " is of course very common in the " acquired " disease. An adult infection often fails to give rise to the classical manifestations of syphilis and even if trivial lesions develop they may be entirely overlooked, but such a case nevertheless develops a positive Wassermann reaction and is thus readily diagnosable as syphilitic. In congenital syphilis, owing to practical difficulties in applying the blood test to babies, the volume of observations upon " latency " of the disease is small, but nevertheless when the infants of syphilitic mothers have been tested they have often been found to give positive reactions even though at the time of examination they have shown no manifestations of the disease.

If then we may assume that an infected infant will develop a positive Wassermann reaction, it is necessary to determine how long after infection the onset of the reaction may be expected, since, as is well known, there is always a period—the period of incubation—which must elapse between the time of infection and the development of its effects in the patient.

The incubation period of the Wassermann reaction, to be carefully distinguished from that of the symptoms, can only be determined from observations on the " acquired " disease, and it has been found that by the methods of testing used in this investigation, a period of two months represents a long incubation: usually it is considerably shorter. Thus, it may be expected that an infant, the subject of congenital syphilis, will develop a positive reaction in, at most, two months after birth, and therefore in this investigation the reaction was performed both at birth and also between two and a-half and four months after birth. By this means it was judged that all infants congenitally infected would be detected.

It is perhaps necessary to lay stress upon the description " congenitally infected," because there is some reason to believe that not all cases diagnosed as suffering from "congenital syphilis" have really been infected from birth.

It may be supposed that an infant may be infected *in utero* by spirochætes passing from the maternal blood through the placenta and it may also be supposed that infection may take place at the time of birth by spirochætes in the vulval secretions of the mother. Again, it is quite possible that an infant may escape infection by both these means and become infected shortly after birth by spirochætes in the milk or by kissing and similar methods. Infection before birth and at birth may be described as "congenital," but infection after birth by suckling cannot be so described with accuracy. Nevertheless, if such cases were common, their exclusion would give a false idea of the incidence of "infantile" syphilis, which is the real object of this investigation. However, although these possibilities must be indicated, it must be allowed that infection by suckling some time after birth is somewhat improbable. If a woman is infective at all, the chances are all in favour of the infection taking place when the fœtus is *in utero* and in a position of maximum exposure to the virus. The available evidence would tend to show that if infection of the infant is to occur, this will take place *in utero*, at birth or very shortly afterwards, in all of which cases the fact will be detected by the reaction performed two and a-half months after birth. The chief fact in support of this view is the exacerbation of the Wassermann reaction and therefore the exacerbation of infectivity which is commonly observed during the pregnancy of a syphilitic woman. This exacerbation has already been shortly referred to[1] and is well illustrated by the following cases:—

E. S., aged 24. 27 Oct., 1910.—Tertiary syphilis; cutaneous gumma on the forearm; four months pregnant; Wassermann reaction positive. 4 Nov., 1910.—Injection of salvarsan; rapid healing of gumma; little effect on the Wassermann reaction. 16 Jan., 1911.—Exacerbation of the Wassermann reaction. 14 March, 1911.—Birth of infant. 24 April, 1911.—Spontaneous decrease in the reaction. 8 Oct., 1912.—Again pregnant; exacerbation of the Wassermann reaction.

Details of the relation of pregnancy to the reaction:—

1910.	27 Oct.	42000	Four months pregnant.
	21 Nov.	42000	Injection of salvarsan.
	5 Dec.	42000	
	19 Dec.	42000	
1911.	2 Jan.	42100	
	16 Jan.	44443	Exacerbation of the reaction.
	7 Feb.	44443	
	14 March	44443	Birth of infant.

1. *See* J. McIntosh and P. Fildes, "Syphilis from the Modern Standpoint." London, 1911 (Arnold), pp. 211 and 214.

	24 April	43200	Spontaneous decrease.
	6 June.	44320	
	7 Sept.	44320	
	20 Dec.	44320	
1912.	13 March	44320	
	8 Oct.	44443	Exacerbation. Patient again pregnant.
1913.	10 Dec.	44440	
1914.	7 Oct.	44440	

Explanation of symbols. 44444=strongest type of Wassermann reaction. 40000=weakest reaction. Intermediate figures represent intermediate strengths of reaction. 00000=totally negative reaction. For further particulars as to meaning of symbols, see paper by P. Fildes and J. McIntosh, " Brain," 1913, xxxvi, 193.

D. R., aged 26. 29 Sept., 1910.—Acute secondary syphilis; injection of salvarsan; rapid healing of lesions and reduction of the Wassermann reaction to negative. 24 Jan., 1911.—Exacerbation of the reaction. 22 March, 1911.—Patient three months pregnant. April, 1911.—Further salvarsan treatment. 20 June, 1911.—Reaction again negative. Sept., 1911.—Baby born.

Details of the reaction.

1910.	29 Sept.	44444	Injection of salvarsan.
	15 Nov.	00000	
	29 Nov.	00000	
	12 Dec.	00000	
1911.	4 Jan.	00000	
	24 Jan.	44440	Exacerbation of the reaction.
	21 Feb.	44440	
	22 March	44444	Three months pregnant.
	April		Two injections of salvarsan.
	2 May	44320	
	23 May	20000	
	20 June	00000	
	26 July	00000	
	Sept.		Baby born.

The exacerbation of the reaction in these two cases is probably to be looked upon as a relapse due to the extra stress of pregnancy and would therefore indicate a recrudescence of the disease and an increased infectivity. The decrease in the reaction following birth, which is apparent in the case E.S., may also be regarded as a spontaneous curing of the disease and therefore a diminished infectivity. It might be thought that the increase and decrease in the strength of the reaction were due to the presence *in utero* of a syphilitic fœtus and its subsequent birth, but in neither of these

two instances can this explanation be correct, since both infants were healthy and remained healthy with negative Wassermann reactions. These examples therefore appear to support the view that infection of an infant by its mother some time subsequent to its birth is improbable.

In addition to the possibilities of infection already enumerated it is desirable to point out that a mother may infect her child with syphilis without there being any question of the infection being congenital, although such a description is often applied, and naturally, when an older child is found to have syphilis the disease is diagnosed as congenital, although the exact method of infection is unknown and may have occurred extra-genitally through any of the accidents common to acquired syphilis. It is not uncommon to find a woman with acute secondary syphilis and a healthy infant several months old. In some of these cases it is clear that the mother was infected after the birth of the child, and yet the child may develop a condition indistinguishable from congenital syphilis. Further, the mother will run grave risks of infecting her other young children, and all these will in after-life be looked upon as congenital syphilitics. Cases of this type, however, do not seriously affect the present investigation;[1] the majority of women who bear syphilitic children do not themselves show obvious signs of syphilis at the time, or indeed at any time.

It is therefore legitimate to conclude that a series of tests performed at birth and two and a half to four months after birth will reveal practically the whole number of infections due to birth by a syphilitic woman. The tests will, however, fail to record such instances of purely acquired syphilis, whether from the mother or strangers, which depend upon purely fortuitous circumstances.

Details relating to the method of the investigation.

The scheme of the investigation was to perform Wassermann reactions upon 1,000 babies through the medium of the blood taken from the umbilical cord at birth, and subsequently ($2\frac{1}{2}$—4 months after birth) to test the babies themselves and their mothers.

The blood from the umbilical cord was collected in a test tube from the placental end of the cut cord and sent to the laboratory, while the blood from the babies and mothers at the subsequent examination was obtained from the thumb or great toe by means of Wright's capsules.

1. See table on page 137. Case No. 922. This patient was treated for primary syphilis one month before the birth of her child. The treatment consisted of neo-salvarsan injections, and it is not therefore surprising that the child was healthy at the age of four months. Should this patient, however relapse, or had she been treated by mercury alone, she would develop secondary symptoms, and almost certainly infect her child. This would be an example of acquired infantile syphilis, but would nevertheless in after years be diagnosed as congenital.

The use of blood from the placenta instead of the infant's own blood is necessary because it is not possible to obtain sufficient for the test either by means of Wright's capsule or from the umbilical end of the cord. From the placental end of the cord, however, blood is very readily obtained, and so far as is known this placental blood does not materially differ from that actually contained in the infant's body. In this paper such a reaction will be referred to as a " placental " Wassermann reaction.

The collection of the material was undertaken by two separate organisations.

Firstly, the placental blood was taken at birth in the houses of the patients by the " green charity " of the hospital consisting of nurses undergoing midwifery training, and also by the "white charity," students similarly employed. The specimens were collected entirely without reference to any pathological state which might be present, and in particular no difficulty was found in obtaining sufficient blood from still-births. Since the reaction requires a relatively large quantity of blood, no test can be performed in the case of an early miscarriage, and further, it is not the habit of the patients to send for the doctor under these circumstances. Thus, this investigation can only deal with more or less viable infants and has no reference to the effect of syphilis in producing miscarriage. The specimens, collected from March to July, 1914, were tested in batches once a week, and whenever a positive reaction was obtained, the nurses and students were asked to make special investigation into evidence of syphilis. It must, however, be understood that this examination was quite superficial since it was felt that any exhaustive inquiry would jeopardise the success of the investigation.

Two and a half months after the birth of the first baby, and from two and a half to four months after the birth of each successive baby, a very large number of postcards were sent out to the women by Mrs. Tanner, the Maternity Almoner of the hospital. These postcards invited them to bring up their babies for her inspection at particular times. In this way groups of 20–25 mothers were collected twice a week, the welfare of each was inquired into, and the baby weighed. After these preliminaries the women were shown singly into an adjacent room with their babies, where they were invited by Dr. G. T. Western to allow a " blood test " to be made. The passage from the atmosphere of a "mothers' meeting" to the presence of a nurse and doctor was very seldom resented. It would appear that those parents (some 300), who were indifferent to the welfare of their children, or who had pronounced views upon the importance of their personal liberty, did not respond to the invitations to visit Mrs. Tanner, and thus those who did respond were quite prepared to trust the hospital in the trivial demands

made upon them. Dr. Western found that if the mother was tested first as a demonstration of the harmlessness of the proceeding, they seldom refused to allow the baby to be done.

In this manner about two-thirds of the mothers and babies were retested after birth. With regard to the one-third which did not attend, a further effort was made by letter to find whether the child was healthy or not with little success.

The technique employed in actually testing the samples of blood was that described recently in " Brain "[1] with unimportant alterations designed to facilitate the testing of large batches.

The nature of the population examined.

The women and children investigated were on the books of the Maternity Charity of the hospital, and belonged to the poorer sections of the population. They all lived within the mile radius of the hospital. So far as concerns their morals it will be understood that only " respectable " persons are admitted to the benefits of this charity. No criminals or wastrels are included. Further, all the infants tested were the offspring of " married " couples. As compared with a similar population in other parts of London, the only marked point of difference lies in the large alien element in the London Hospital district. Judging the nationality of the women from their names, it is found that about half are aliens, and since it is sometimes stated that Jews are more moral than others, it might follow that results obtained from this population would tend to underestimate the amount of syphilis. There is, however, no evidence that this is so. Further, in another investigation (not yet published), it was found that the incidence of syphilis among the Jews did not differ materially from that of the Christians. In the present case, among thirty-three women with syphilis there were eighteen with alien names and fifteen with British names. It appears, therefore, that the large alien element does not interfere with the application of any deductions drawn from this population to populations of similar social grade in other parts of London.

The Wassermann reaction in infants at birth.

The Wassermann reaction was carried out upon 1,015 different sera collected at birth from the placental end of the umbilical cord, and fourteen were found to give positive reactions (1.3 per cent.). These infants were specially examined and with the exception of one were declared to be healthy. The exception[2] exhibited evident symptoms of congenital syphilis, and was placed under treatment but died in twelve days. No autopsy was performed. The large

1. P. Fildes and J. McIntosh, " Brain," 1913, xxxvi, 193.
2. Vide Table, p. 136. Case No. 129.

number of cases which gave a negative reaction at birth were also devoid of symptoms of syphilis, and thus it follows that, although 1.3 per cent. of new-born infants may give a positive Wassermann reaction, only 1 case in 1,015 exhibited manifest symptoms of syphilis.

The occurrence of positive placental reactions at birth in apparently healthy infants might be due to several causes. For instance, they might denote the onset of an infection, the symptoms of which might appear later, but upon subsequent examination at two and a half to four months of age this explanation was not found to be satisfactory.

Of the thirteen healthy children with positive placental reaction at birth, seven were brought up by their mothers for re-examination, and six did not attend. The seven babies were still found to be healthy, and now gave negative Wassermann reactions; on the other hand, all the mothers gave positive reactions. It would therefore appear that a positive placental reaction at birth does not necessarily imply the presence of syphilis in the infant, but may simply be due to the passage of substances from the maternal blood to the circulation of the child, which are capable of producing a positive reaction. The phenomenon does not depend upon the use of blood from the umbilical cord, but is also met with when the blood is obtained direct from the infant.

Example. Infant of E.H., aged 40. Tabes dorsalis, with positive Wassermann reaction:—

9 Nov., 1912. W.R. at birth. 41000.
W.R. at 11 days. 41000.
W.R. at 3 months. 00000.

The infant was healthy and remained so.

Since only seven of the thirteen cases positive at birth were available for subsequent examination, it is clearly not justifiable to record the result of these tests only, and deduce that none of the thirteen cases were syphilitic. It is possible that the six infants which did not attend had died of syphilis, but on the other hand, it is highly improbable. One infant, at least, was known to be alive and well. Strong indirect evidence is obtained against the suggestion that the six infants which failed to attend had died of syphilis, by comparing the attendance of the "positive" cases with the "negative." It will be found that about six-tenths of the "negative" cases attended the second time and five-tenths of the "positive." Thus the reason for non-attendance is probably the same in both cases. The failure to attend was much more probably due to indifference or hostility on the part of the parents.

On the whole it would appear that a positive placental reaction at birth is very seldom due to a syphilitic infection of the infant,

but merely to the passage of the reacting substance from the blood of a syphilitic mother.

The Wassermann reaction in infants during the early months of life.

The 1,015 mothers were invited to come under observation with their babies at a period varying between two and a half and four months after birth. For various reasons it was found possible to carry out the reaction on 660 babies only. The remainder of the mothers either did not attend with their babies or refused to permit the examination to be made. The following result was obtained: 660 infants tested; three positive reactions (0.45 per cent.).

It is now necessary to discuss whether the babies tested represented a true sample of the whole so far as syphilis is concerned, or whether an undue proportion of syphilis might be expected among those who did not attend.

Twelve of these were known to be stillborn, and fourteen to have died after birth, but there was little evidence available that the deaths or still-births were due to syphilis. Without exception the Wassermann reaction of these stillborn or dead babies was negative at birth, and in every case tested (17), the mother gave a similar result.

The still-births were due to "repeated still-births," difficult labour, etc. In one case, however, the infant had an enlarged liver, and the mother had attended the Dermatological clinic of the hospital (Dr. Sequeira) for psoriasis. There was no other evidence of syphilis, and the Wassermann reaction had been several times negative. The causes of death were described as premature labour, enteritis, "inquest case," "spinal trouble," wasting, etc.

There is, of course, a common tendency to associate with syphilis various conditions, such as repeated miscarriage or still-births, wasting, enlarged liver, "rash," or fits, but this association is merely tentative, and due to obscurity in the etiology of such conditions. All such manifestations may occur in syphilis, but they are more commonly due to other causes and cannot be accepted as proving the presence of syphilis in opposition to a negative placental Wassermann reaction.

With regard to the large number of infants which were not known to be dead, circular letters disclosed that thirty-nine were living eight to ten months after birth, although a few had minor complaints.

The impression obtained as a result of the inquiries was that refusal to report was merely due to indifference, and had no relation to the health of the mother or child. It is therefore highly probable that the mothers and babies who responded were a fair sample of the whole number as regards syphilis, and therefore it may be held that the figure 0.45 per cent. is not liable to much error.

The three infants which gave a positive reaction on the second examination[1] were apparently healthy at birth and gave an entirely negative placental reaction; two of them remained apparently healthy at the time of the second test (two and a half months old), but the third had developed undoubted symptoms of congenital syphilis, and was under treatment (two months old). Their mothers had positive reactions, but evidence of syphilis was obtained only in the last case, this woman being a known syphilitic.

It would appear that these cases are examples of early "congenital syphilis," the time of infection being at or shortly after birth, or perhaps so late in pregnancy that the reacting bodies were not in sufficient amount to be detectable at birth. It is presumed that the two infants at present apparently healthy will subsequently develop manifestations of disease.

The incidence of syphilis among the infants examined.

The incidence of syphilis among infants may now be calculated from the data given.

The total number of cases is arrived at by including only those, whether living or dead, whose mothers came up for examination. Thus—

660 infants examined at and after birth.
7 infants stillborn and examined at birth only.
10 infants dead and examined at birth only.

Total..... 677

One gave a positive placental reaction at birth, and died of syphilis.

Seven gave positive placental reactions at birth, and negative reactions later. These are considered to be non-syphilitic.

Three were negative at birth and positive later, one having symptoms. These are considered to have syphilis.

Thus only four cases in 677 (0.59 per cent.) are shown to be syphilitic, and of these only one died during the period of observation.

Further, while sixteen children were lost from various apparently non-syphilitic causes, only one died of syphilis.

It should be remarked that this statement refers to the minimal incidence only, since it is quite possible that unavoidable causes have introduced a certain error into the results. Nevertheless a careful study of the probabilities does not suggest that the underestimation is great.

On referring to the Table upon pp. 136 and 137, it will be observed that there is a considerable probability of syphilis in two cases (Nos. 220 and 622), which did not attend for re-examination.

1. Vide Table, pp. 136 and 137. Case Nos. 228, 446, and 988.

In each instance, since the placental reaction of the baby was positive at birth, it is reasonably certain that the mothers were syphilitic.[1] In one case it was the first pregnancy, and in the other the mother was only twenty years old, and therefore the infection of both was probably recent and liable to be transmitted. It is, however, undesirable to make abnormal efforts to find out the fate of these children, since the material would then no longer be a random sample. The possibility of error arising out of a necessarily small series cannot be eliminated.

The relation of syphilis in the mother to syphilis in the infant.

The Wassermann reaction was performed on the mother when she brought up the child for examination two and a half to four months after birth.

In every case in which a positive result was obtained in the child, either from the placenta at birth or after birth, the mother also gave a positive reaction. This result is in support of the view, which is now generally held, that any woman who gives birth to a syphilitic child must herself be syphilitic. The number of cases is of course too small to establish any opinions which may be held regarding the effect of paternal syphilis upon the child directly, but it is clear that if the mother is always syphilitic it will be practically impossible to maintain the argument that a fœtus *in utero* can be directly infected by the father.

In addition to those syphilitic mothers who bore children giving positive reactions either at birth or later, sixteen other women were positive, although their offspring were healthy and gave persistently negative results. Thus in a total number of 677 women 27 gave positive Wassermann reactions, namely, 3.9 per cent.

The relation of the reaction in the mother to that in the child may therefore be tabulated as follows:—

16 syphilitic women bore healthy children with negative reactions.

7 syphilitic women bore healthy children with fleeting positive placental reactions.

3 syphilitic women bore healthy children which subsequently developed positive reactions.

1 syphilitic woman bore a syphilitic child.

Thus only four out of twenty-seven syphilitic woman had syphilitic offspring.

Technical considerations.

Owing to considerations of secrecy and to the difficulty in obtaining a sufficient quantity of blood from an infant for the

1. The old suggestion that an infant might be infected with syphilis by the father while the mother escaped infection is now discredited.

purpose of carrying out the Wassermann test, there has been a tendency for extensive investigations to become confined to the reaction obtained in the blood from the umbilical cord. Similarly it is common practice to utilise this blood for diagnostic purposes when an infant is diseased. From the present results it is however clear that this method leads to great error. Thus only once when the placental reaction was positive at birth was the infant syphilitic; in all other cases examined the reaction was transient and in all probability the infants were not syphilitic. There is, however, a further objection to the use of blood from the umbilical cord. In three out of the four cases of congenital syphilis observed during this investigation, the placental reaction at birth was negative and the three cases would not have been detected if reliance had been placed upon this test alone.

It must therefore be stated that the Wassermann reaction performed with umbilical cord blood is not diagnostic of syphilis in the infant.

It will be observed that not every woman with a positive reaction induces a positive test in the umbilical cord blood; on the contrary, in the majority of cases this is not so. For this reason tests applied to the placental blood give no index of the amount of syphilis among the women.

Conclusions.

1. It is assumed that the great majority of cases of congenital syphilis will develop a Wassermann reaction in two and a half to four months after birth. It is therefore not considered necessary to prolong the observation further for the present purpose.

2. The population examined was probably representative of other groups of similar social status in different parts of London, namely, the respectable labouring classes.

3. In this population :—

(*a*) Only one baby in 1,015 showed symptoms of syphilis at birth.

(*b*) Only three babies in 660 developed syphilis as evidenced by a positive Wasserman reaction during the period of observation, and of these only one showed symptoms.

(*c*) Thus only four instances of syphilis were detected among 677 babies (5.9 per 1,000), and of these one died and two showed no symptoms.

(*d*) Only one child died of syphilis, while sixteen were lost presumably from other causes

4. 27 (3.9 per 100) of the women gave a positive Wassermann reaction, but only four of these transmitted syphilis

5. The Wassermann reaction obtained with blood from the placental end of the umbilical cord is not diagnostic of syphilis in the infant but of syphilis in the mother. However, only a minority of syphilitic women induce this positive reaction in the umbilical cord serum, and only a minority of syphilitic children give this reaction at birth.

General conclusion.

The observations made in the population thus studied, point to the conclusion that the ravages caused by congenital syphilis in infants are sometimes exaggerated.

I desire to record my thanks to Mrs. Tanner, the Maternity Almoner of the London Hospital, for the great amount of time and labour she has expended upon this investigation, and also to Dr. G. T. Western for undertaking the difficult task of examining the infants and mothers. I also desire to acknowledge with thanks the facilities afforded to me by Miss Lückes, the Matron of the Hospital, and by Dr. Russell Andrews and Dr. Drummond Maxwell, in whose charge were the whole of the patients. To Professor Bulloch I am indebted for advice in the organisation of the investigation.

No. of case.	W.R. at birth.	State of baby at birth.	Age at second test. Months.	Result of second test.	State of baby at second test.	W.R. of mother.	State of mother.
63	+	"Very healthy."	2¾	0	"Very good."	+	Age. 31. No evidence of syphilis.
73	0	...	2½	0	Normal	+	Age?
75	+	"Very healthy."	...	...	(Known to be well.)	...	Age 33. No evidence of syphilis.
122	0	...	2½	0	Normal	+	Age?
129	+	Manifest signs of congenital syphilis.	...	...	Died 12 days after birth.	+	Age 32. Two children died young. No symptoms.
219	0	"Healthy"	1½	0	"Quite well." At 8 months, "Very good."	+	Age 27. Syphilis 1909. No symptoms since. 3 still-births. This first living child. 1913, continuous mercury pills. Feb. 1914, two doses of neosalvarsan. Baby born April.
220	+	Normal	...	...	...	...	Age 20. No evidence of syphilis.
221	0	...	2½	0	Normal	+	Age 33. 3 still-births, 1 living 2½ years.
228	0	...	2½	+	"Apparently well."	+	Age 28.
290	0	...	2½	0	Normal	+	Age 34.
325	0	...	2½	0 0 twins.	Normal	+	Age 36.
338	+	"Healthy"	...	...	...	...	Age 29. No evidence of syphilis.

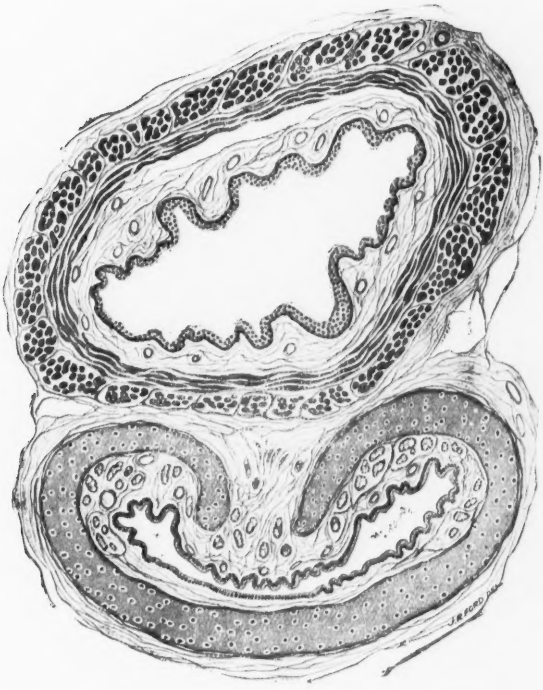
No. of case.	W.R. at birth.	State of baby at birth.	Age at second test. Months.	Result of second test.	State of baby at second test.	W.R. of mother.	State of mother.
416	o	...	2½	o	Normal	+	Age 28.
446	o	...	2½	+	"Quite well."	+	Age 32.
448	o	...	2½	o	Normal	+	Age 25. Has lost 5 children in infancy.
484	+	"Quite healthy."	2½	o	"Very well."	+	Age 28. 2nd, 3rd and 4th children died in infancy; 1st, 5th, 6th and 7th alive.
493	+	"Perfectly healthy."	2½	o	"Said to be wasting."	+	Age 36. "A miserable woman." First 3 still-born; next 4 living.
515	+	"Quite well."	2½	o	"Big baby, healthy."	+	Age 33. One miscarriage; 3 alive and well.
549	+	"Quite well."	2½	o	Normal	+	Age 26. 1st chlid alive, "ulcers on eyes." 2nd died convulsions, 3rd and 4th miscarriages. 5th is the present.
622	+	"Quite well."	...	...	...	...	Age 23. Quite well. Married 7 months. 1st child.
653	o	Normal	2½	o	Normal	+	Age 44.
672	+	"Healthy"	2½	o	Normal	+	Age 35. 11 children—8 alive, 3 died young.
734	+	Normal	...	...	...	..	Age 41. No evidence.
783	+	"Healthy"	...	...	...	...	Age 24. No miscarriages. 2 other children healthy.
790	+	"Healthy"	4	o	"Strong child."	+	Age 21. First child. Mother's eyes "bad" 3 years ago. ? a congenital syphilitic.
836	o	Normal	4	o	Normal	+	Age 29.
888	o	Normal	3½	o	Normal	+	Age 32.
894	o	Normal	4	o	Normal	+	Age 35.
910	o	Normal	4	o	Normal	+	Age 27.
922	o	Normal	4	o	"Healthy"	+	Age 25. April, 1914, Primary syphilis—W.R.+. June 1914, Hg+2 doses neosalvarsan. Baby born July.
935	o	Normal	4	o	Normal	+	Age 33.
978	o	Normal	4	o	Normal	+	Age 35.
983	o	"Healthy"	2	+	"Wasting and syphilitic rash."	+	Age 26. Old case of syphilis. W.R. + and Hg treatment 3 years. 4 still-births.

The Condition of the Larynx and Trachea in the Still-born Infant and its Bearing on Artificial Respiration.

By E. A. Barton.

I am anxious to draw your attention to one or two points the recognition of which appears to me to be of prime importance in the resuscitation of the apparently stillborn living child. I have often speculated on the condition of the trachea before birth. It is conceivable that if the trachea were completely filled with fluid the child might be drowned in its first effort at inspiration, and it is equally obvious that the trachea could not contain air. Therefore the trachea must be for the most part a closed tube and the first inspiration must convert a potential into an actual lumen.

On examination, postmortem, of a number of stillborn children in whom no air has passed the glottis I find *in the majority* of cases the following condition. For about $\frac{1}{3}$ in. below the glottis, which is invariably closed, the trachea is open, narrowing like a funnel from above down till the point is reached where the lumen is entirely obliterated by the folding in of the ends of the cartilaginous rings behind. The trachea is now flattened from before back, and where the posterior part of the rings meet one another on the dorsal surface is a vertical groove. The muscular posterior wall of the trachea is folded in such a manner that by its contraction the infolded cartilage ends would be separated and an actual lumen be formed from a potential one. This condition holds till the region just below the bifurcation, where the irregularity of the disposition of the cartilages prevents the complete apposition of the surfaces, the lumen again being filled with mucus. This does not, however, apply to all cases, as I have found that in a few the trachea is filled with mucus and open throughout its length though flattened, suggesting that some inspiratory effort had been made which, contracting the posterior wall of the trachea, had unfolded the cartilages even with the glottis closed. Such a condition might have taken place at the moment of birth. One may look on the thorax as a whole, then, as an airless, semi-rigid body, the lungs completely atelectatic and the ribs in close contact with them. Therefore at birth the thorax occupies a smaller space than it can ever occupy after the first breath, let expiration be never so complete. There is some reason, too, to suppose that the ribs before the first breath are under an outward elastic tension tending to expand the chest and aiding by their outward spring the completeness of the first inspiration. My reason for this assumption lies in the fact that on opening the chest



Section through trachea and œsophagus of a new-born infant who has never breathed; note flattening of trachea and other appearances described in test.

of a child that has never breathed I find that there is a considerable space between the chest wall and lungs, the latter appearing to lie at the bottom of a definite cavity. As the airless lungs cannot alter their volume this cavity must be made by releasing some tension in the chest wall itself.

The first inspiration of life therefore is a very complicated process: The glottis must be opened, the posterior wall of the trachea must contract and by its contraction unfold the curled cartilages, converting a closed into an open tube, the ribs under their outward tension spring open, and air rushes into the till now solid lungs. The small amount of mucus in the trachea and larger bronchi is drawn into the lungs, but so small is this amount that in the cry accompanying the first expiration there is seldom any mucus rattling.

The bearing of all these points on the judicious use of artificial respiration is obvious. To attempt to apply Silvester's method to a child who has made no effort to breathe, or rather in whom the glottis is still closed and the trachea empty of air, is waste of precious time. On attempting it one sees the abdominal contents drawn upwards, the chest not expanding in the smallest degree as the ribs are in contact with the solid lung beneath. The glottis must be opened, the tracheal surfaces separated, and then only is artificial respiration possible by methods like Silvester's.

There are many cases, notably after protracted labour or from other causes, when the newborn child makes or has made no attempt at all at the initial inspiration. I do not refer to the infant who having taken a single breath requires but a little artificial encouragement to start on its separate existence, but rather to the flaccid child whose heart is still beating even though at long intervals and in whom possibly Silvester's method has been tried and failed. I am quite sure I have been able to restore life to some infants whom I should have been unable to save before I realized the importance and significance of the anatomical conditions which obtain before the child has made the first voluntary effort at inspiration. The conditions of the thorax of an infant before air has entered the glottis is that of a solid body, and any passive attempt to inflate the lungs until the glottis is opened and the tracheal surfaces separated is impossible by any movements directed to that end. The pulling up of the arms to expand the chest has no effect on the glottis, as, there being no air in the chest there is no inducement for the air to enter, the pressure of air being no greater on the glottis than anywhere else on the surface of the chest. Therefore, the main result of my investigations point to this: If the newborn infant has never made an attempt to breathe and makes no effort the glottis must be mechanically opened either by intubation or blowing into the child's mouth, the latter being performed with the

child's nose closed. The small risk of intubation lies in lacerating the vocal cords, and that this is not an imaginary one I have reason to know; but it is far easier to force a current of air into the chest by holding the child's nose and blowing into the infant's mouth. This may drive air into the Eustachian tubes and middle ear, and certainly blows air into the stomach, but I have never seen ill-results from either cause. The force used should not be great, and as soon as the lungs are distended any physical or artificial respiration is carried out easily.

Torsion of a Normal Ovary (Natural size).

The ovary and the part of the tube removed. A vertical section of the ovary has been made.

SELECT CLINICAL REPORTS.

(Under this heading are recorded, singly or in groups, cases to which a special interest attaches either from their unusual character or from being, in a special sense, typical examples of their class.)

A Case of Torsion of a Normal Ovary.

By F. J. F. Barrington,
Surgical Registrar at University College Hospital.

The patient was a married woman, aged 38, who had had twelve children. The first child was perforated. The second, delivered with instruments at term, was alive and aged 19. The third was delivered with instruments and born dead. The fourth, delivered with instruments at term, was alive. The fifth, sixth and seventh were killed in birth. The eighth was induced and born dead. The ninth was induced and lived $2\frac{1}{2}$ years. The tenth was induced and lived six months. The eleventh was induced, is alive and aged four. The last was delivered by Cæsarean section, is alive and aged nearly seven weeks.

At 9.30 p.m. on the day before admission, when walking upstairs to bed after a walk, she got a sudden pain all over the abdomen which gradually got worse in the right iliac region. A quarter of an hour after the onset, diarrhœa set in and continued till the following noon. Vomiting began soon after the diarrhœa and persisted till 3 p.m. the next day, when the pain was much less severe. She had not felt faint whilst the pain was severe and had kept up walking about most of the night. There had been no vaginal bleeding. She was not usually constipated.

On admission the patient did not look ill, the pulse was 76 and the temperature normal. The abdomen moved well on respiration and was not distended. There was no superficial tenderness or rigidity. On deep pressure there was marked tenderness in the right iliac region. Per rectum a lump could be felt above the cervix, it was rather larger than the cervix and was independent of the uterus.

At 5 p.m. (nearly 20 hours after the onset) a muscle splitting incision was made in the right iliac region under chloroform. There was a considerable excess of clear fluid in the peritoneum which was not blood stained. The appendix was quite normal; it was removed. A tense elongated lump was felt lying behind the

uterus rather to the right of the middle line with its lower extremity at the bottom of Douglas's pouch. The incision was extended half way across the right rectus. The lump was then seen to be the right ovary which, with the distal part of the tube, was twisted on its pedicle at least one complete turn and tucked downwards in Douglas's pouch. There were no adhesions to the ovary or uterus. The pedicle was tied off and the ovary with part of the tube removed. The left ovary appeared normal. The abdomen was closed. Convalescence was uneventful.

The right ovary was about twice the size of the left and measured $6\frac{1}{2} \times 3\frac{1}{2} \times 3$ cm. after hardening. Its surface was a uniform blackish purple colour, and the part of the tube distal to the twist was dark red. There was no lymph or adhesions on the surface. A vertical section showed the parenchyma to be dark red from blood staining; the hæmorrhage did not extend into a corpus luteum or into the Graafian follicles.

The external conjugate was $6\frac{7}{8}$ ins., the interspinous diameter $9\frac{1}{2}$ ins., the intercristal $10\frac{1}{2}$ ins.

Two Cases of Congenital Malformation of the Female Genitalia.

By Robert P. Beatty, M.D., D.P.H.

The rarity of marked abnormalities in the development of the uterus and vagina is sufficient to warrant the publication of the following interesting cases.

The first came under my notice in August 1910, but, as I removed the septum, and had not taken the precaution to have a photographic record to confirm my statements, I hesitated to publish it, as some doubts were expressed by colleagues who saw the case, elsewhere, after the wounds were healed and only a small tag of mucous membrane was left to represent a septum.

However, as a second case has occurred in my practice, I have had a photograph taken and publish the two cases together.

Case I. A robust, healthy woman, aged 32; has two children, one aged 5 years and the other 2. The elder child is somewhat deficient mentally. The woman herself is the daughter of cousins.

Her first labour lasted three days, and was "very difficult." As the doctor who attended her died shortly after the confinement, I can give no further details.

The second labour was rapid, the child being born before the doctor arrived, and there was no reason to make an examination.

When examined in the Marion-Sims position the uterus was felt to be of about normal size, but broader and shorter than usual, and no abnormality was felt in the vagina.

When she was examined in the lithotomy position, a thick septum was found passing in the mesial plane from behind the orifice of the urethra to the posterior vaginal wall, and extending up the vagina for about two inches and a half. As it interfered with curetting, which was to be performed for endometritis, I divided it longitudinally, having first satisfied myself that there were no pouches from the rectum or bladder. The cut surfaces showed bundles of muscular fibres, over which I sutured the mucous membrane. The muscle fibres speedily atrophied, so that only a small tag of mucous membrane showed some months later. She has not become pregnant again.

In this case there was no vaginismus or dyspareunia.

Case II. A delicate anæmic woman, aged 24, married two years, came to me on August 12, 1913, complaining of pelvic pains, loss of appetite and a white vaginal discharge. Menstruation had begun at the age of 20, and had been regular. She had suffered great pain on coition. As there was very marked vaginismus, she

was admitted to the Victoria Hospital, Swindon, and examined under an anæsthetic, when the following condition was found :—

There was a complete septum from the region of the hymen (which was still present as a thin layer of mucous membrane) reaching up to the uterus, and dividing the vagina into two almost equal passages, the septum being in the middle line. At the upper end of each vaginal passage was an os uteri, the left being slightly larger than the right, but both were only about half the normal size, as seen through the speculum. The septum was fibrous, and neither uterus could be palpated bimanually.

After having explained the condition of affairs to the patient and her husband, who were very desirous to have a child, it was decided to remove the septum, which was done on August 26, 1913, as in the former case. After this I was then able to palpate both uteri, which were unicornute and small, but the right gave one the impression of being a mere nodule on the side of the left.

The patient had menstruated late in July, and there was some pulsation in the left lateral fornix at the time of the operation, but I did not think that she was pregnant, as there were no other symptoms. But menstruation did not recur, and on February 25, 1914, she was delivered of a seven months' male child, from the left uterus. There was no difficulty in the labour, the child presenting in the right occipito-anterior position. What the labour would have been like with the stiff membrane running down the vagina I leave to the reader to estimate.

A full term female child was delivered in March 1915, without any abnormal symptom, from the left uterus.

The possibility of the membrane being the result of a plastic development following vaginitis, either from gonorrhœa or any other cause, may be ruled out by the presence of the double uterus.

These cases are interesting from the fact that they show different degrees of failure in the normal resorption of the septum between the united Müllerian ducts in the fœtus, for a study of which I must refer the reader to Felix's article on the subject in Chapter XIX of Keibel and Mall's "Manual of Human Embryology," and to Allbutt's "System of Gynæcology."

In Case I the failure is confined to the lower part of the vagina—the condition known as *vagina septa infra*. It is quite possible that the septum may have been complete before the first confinement, and that it may have been damaged then.

In the second case we have a complete septum from the region of the hymen to the fundus uteri, resulting in a double set of genital organs, as the result of which one can imagine the possibility of two separate pregnancies occurring during periods which overlapped.

There is a specimen in the Museum of the Royal College of

Surgeons which is almost identical with this. The only possibility of a more extensive case of double organs would be one in which the vulva and bladder were also divided mesially, as in a case reported by Suppiger (Allbutt's "System of Gynæcology), in which the coccyx also was bifid.

In both my cases the vaginal septum was mesial and directly antero-posterior, when examined in the "lithotomy" position, although most references point to some torsion of the vaginæ, one being placed somewhat anteriorly. The first patient was examined at least twice in the left lateral position by different doctors, including myself, and it was not until she was placed in the dorsal position that the condition was discovered.

The number of women with double vagina or uterus must be very small, but one wonders how many cases are missed through the routine of examining gynæcological cases in the left lateral position, instead of in the dorsal.

TECHNICAL MEMORANDA.

Anterior Colporrhaphy and its Combination with Amputation of the Cervix as a Single Operation.

By W. E. FOTHERGILL, Manchester.

A PRELIMINARY note on the modifications now figured appeared in the *British Medical Journal*, April, 1913, and a later development was mentioned in this Journal in July, 1914. The plates, now reproduced by the courtesy of the *American Journal of Surgery*, explain the technique much better than the rough diagrams previously used. I have therefore thought it worth while to publish them in this Journal together with a brief explanatory text.

Fig. I. illustrates a modification of ordinary anterior colporrhaphy which is useful in cases of true prolapse when the uterus is not elongated and when the cervix is healthy and not hypertrophied. The dotted line shows the usual incision. The plain line shows the incision extended upwards and backwards on both sides of the cervix so that the wound becomes a triangle with its apex at the urethral orifice and its broad base crossing the vaginal roof just in front of the cervix. The closure of this wound from side to side brings together in the middle line in front of the cervix the tissues which formerly lay at its sides. The cervix is thus pushed upwards and backwards towards the hollow of the sacrum. The body of the uterus at the same time passes forward into a position of anteversion and is kept there by intra-abdominal pressure. The recurrence of prolapse is thus effectively prevented. The operation is completed by a moderate repair of the perineum done so as to restore the natural size, slope and curve of the vagina. This modification was first described by the writer in the Transactions of the Edinburgh Obstetric Society, 1907–8.

Figs. II. to VI. illustrate the combination of anterior colporrhaphy with amputation of the cervix as a single operation. This device is useful in cases of true prolapse whenever the uterus is more than three inches long and whenever the cervix is lacerated and unhealthy. It is also useful in cases of elongation of the cervix with inversion of the vagina from above downwards. In short, whenever it is necessary to amputate the cervix when operating on any variety of genital prolapse, it is best to remove the cervix together with part of the anterior vaginal wall. For ordinary amputation of the cervix is a bad preliminary to an anterior

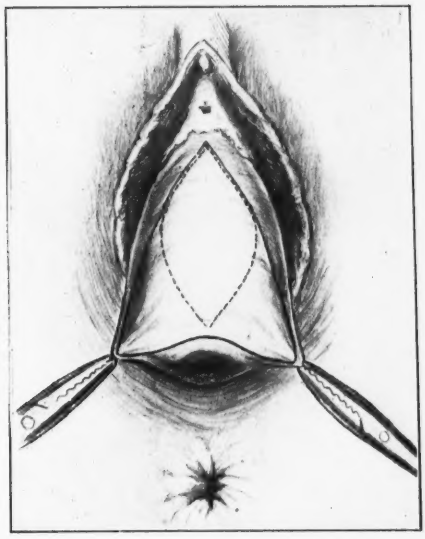


Fig. 1. Colporrhaphy without amputation of the cervix.

The dotted line shows the usual incision. The plain line shows the author's incision, extending upwards and backwards on either side of the cervix.

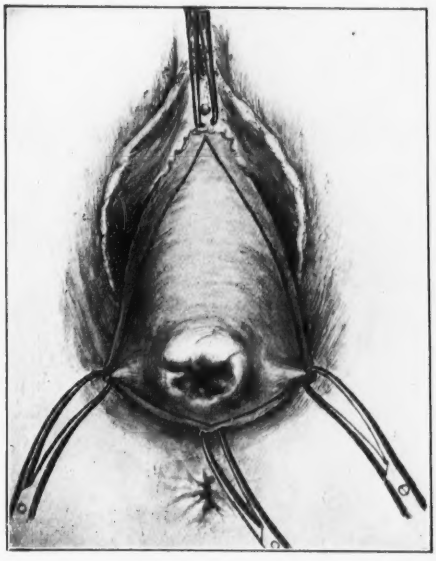


Fig. 2. Colporrhaphy combined with amputation of the cervix.

The line of incision.

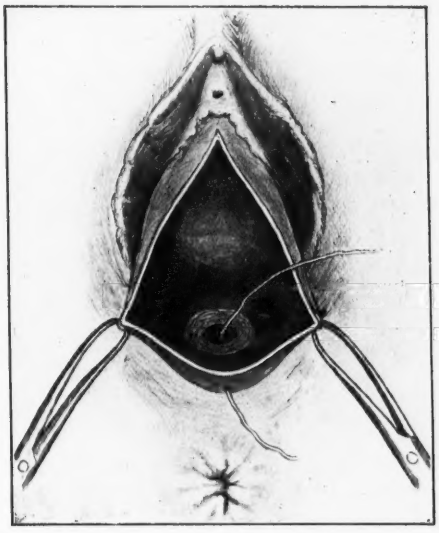


Fig. 3. Colporrhaphy combined with amputation of the cervix.

The triangle of vaginal wall has been removed with the cervix in one piece. The suture has been inserted from the cervical canal through uterine wall and vaginal wall.

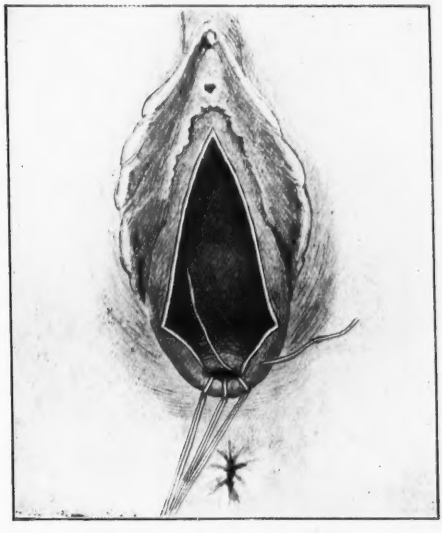


Fig. 4. Colporrhaphy combined with amputation of the cervix.

The first three sutures have been inserted and tied. They are left long and serve as tractors until the suturing of the cervical stump is complete. The fourth suture has been inserted through the vaginal wall and uterine wall into the cervical canal.

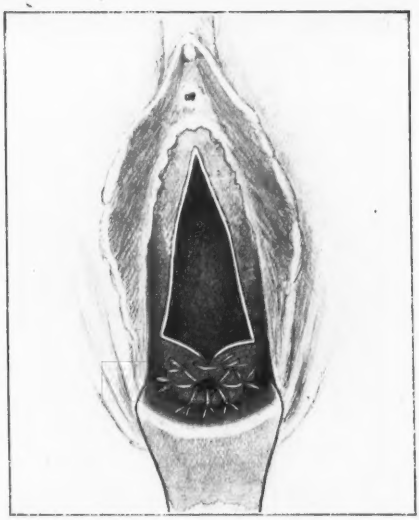


Fig. 5. Colporrhaphy combined with amputation of the cervix.

The suturing of the stump of the cervix is complete. The first suture uniting the sides of the wound has been inserted and tied.

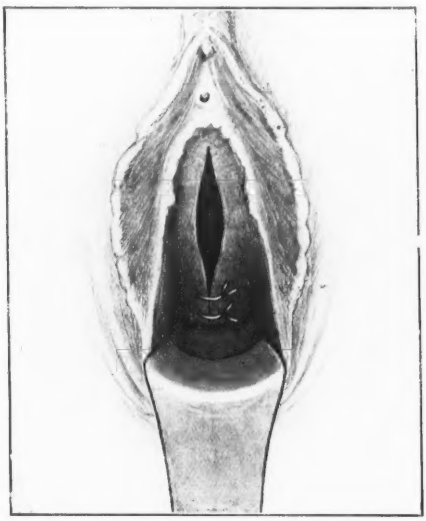


Fig. 6. Colporrhaphy combined with amputation of the cervix.

More sutures have been inserted, tied, and cut. The stump of the cervix has passed upwards and backwards into the hollow of the sacrum and is no longer visible. The uterus is now anteverted.

colporrhaphy; and, when these two operations have been done *seriatim*, the uterus is left in a position of retroversion, with the cervix looking downwards and forwards and much too near the vaginal orifice. It is therefore best to combine the two operations in one after a preliminary dilatation of the cervix and curetting.

The incision for this purpose is shown in Fig. II. When the vaginal wall enclosed by the incision has been separated from the bladder and the paravaginal and parametric tissue, the cervix is clipped round and round as far as may be necessary. It is then cut straight across so as to leave the uterus not more than three inches long. The amputated portion of the cervix comes away in one piece together with the flap of vaginal wall. Fig. III. shows the appearance of the wound. Figs. IV., V. and VI. show the way in which it is closed.

Catgut is the only suture material, as after this operation it is impossible to get access to the parts for the removal of stitches. When the stump of the cervix has been covered in the sides of the wound begin to approach one another in front of it. The cervix then recedes towards the hollow of the sacrum, and the remaining stitches must be tied with the fingers within the vagina. For if enough vaginal wall has been removed the sides of the wound will not come together unless the uterus is well within the pelvis. At the end of the operation the stump of the cervix is far back, high up and out of sight; the uterus is in anteversion. The perineum should be repaired so as to restore the original condition without unduly narrowing the vagina.

This operation has been completely satisfactory in several hundreds of cases. It has repeatedly stood the test of subsequent parturition and has been used for several patients over 70 years of age. It renders abdominal operations, hysterectomies and interpositions absolutely unnecessary even for the worst cases of prolapse. It should not be done (1) just before a menstrual period, (2) during the four or five months following parturition, or (3) until a clean and healthy condition of the parts has been secured by rest and treatment. The parts should not be irritated at the beginning of the operation by unduly vigorous attempts at disinfection. Vaginal packing should not be used at the end of the operation unless it is really necessary to check oozing. During healing vaginal douching should be avoided except in occasional cases which are complicated by infection of the wounds.

Obituary.

Mr. E. W. Scott Carmichael, Edinburgh.*

By the death of this gentleman, which took place in Edinburgh on June 12th, a career which had already given promise of great brilliance has been cut short, and the surgical world of Edinburgh has been deprived of one of its most gifted members. Mr. Carmichael came of a family of doctors: his grandfather practised in Edinburgh, and his father, Dr. James Carmichael, was for long on the acting staff of the Children's Hospital, and is now one of the Consulting Physicians to that institution. It is natural, therefore, that Scott Carmichael should have followed their footsteps. After a successful university career he graduated in medicine in 1895, and after graduation filled a number of junior appointments with great acceptance, studying in the intervals in Paris, Berlin and Greifswald. His first important appointment was as extra Surgeon to the Children's Hospital, and this to some extent determined the line of work he afterwards adopted. He resolved to specialise in surgery and gynæcology, and he approached the latter subject through a training in general surgery, instead of beginning, as most gynæcologists do, with a special study of the diseases of women from the obstetrical standpoint. His departure was thus unique so far as Edinburgh was concerned, and in his successful application for a vacant post on the surgical staff of the Royal Infirmary he intimated that he did not consider himself precluded from applying for a gynæcological post at a later period. His combined specialism in surgery and gynæcology was proving very successful, and was yearly bringing him a wider reputation and an increasing amount of work, when his illness befel him and cut him off at the early age of 42. During his active career he had made a number of observations of clinical value, and had embodied these in communications to the medical press. His contributions to the *Journal of Obstetrics and Gynæcology of the British Empire* included articles on "Hernia of the uterine adnexa," "The possibilities of ovarian grafting in the human subject, as judged from the experimental standpoint," and "Pelvic exudations: their diagnosis and treatment studied clinically." Latterly he had been at work on a book on gynæcological surgery. Carmichael was a man of most

* We are indebted to the Editor of the "Medical Press and Circular" for permission to reproduce this notice, with slight additions.

lovable character; he had hosts of friends and no enemies, and although his unorthodox views as to the preparation necessary for a successful gynæcologist aroused criticism and some opposition, he held to his opinions manfully; through his straightforwardness commanded respect; and through his success was rapidly justifying the position he took up. Mr. Carmichael married some years ago the daughter of the Rev. D. H. Francis, Llandefailog, Brecon, by whom and three young children he is survived. His funeral from the church of the Holy Trinity was attended by a large gathering of friends and colleagues, and the deepest sympathy is felt for his widow and family in their bereavement.

REPORTS OF SOCIETIES.

ROYAL SOCIETY OF MEDICINE.

Section of Obstetrics and Gynæcology.

Meeting held July 1st, 1915, Dr. W. S. A. Griffith in the Chair.

Specimens were shown by Mr. J. D. Malcolm: (1) Papilliferous carcinoma of the ovary associated with adenomyoma of the uterus; (2) Fibromyoma free from attachments in a pelvic abscess.

Remarks by Dr. Herbert Spencer, Dr. Hedley and Dr. Cuthbert Lockyer.

Mr. E. A. Barton read a short paper on

The Condition of the Larynx and Trachea.

This paper showed, as a result of a number of *post-mortem* examinations on still-born infants that had never made any attempt to breathe, that in all cases the glottis is closed, and in a majority the lower half of the trachea was also occluded, the posterior muscular wall being folded into the lumen and the cartilage rings sharply flattened and incurved, so that the trachea presented on section a very flattened oval. A deep sulcus formed by the interval between the ends of the incurved cartilages runs vertically down the posterior surface of the trachea. It was also suggested that an outward elastic tension of the ribs might further aid the initial inspiration. The bearing of these observations on artificial respiration of the still-born flaccid infant went to show that, until the glottis was opened mechanically and the trachea was made patent, it was useless to attempt any postural or other means to inflate the lungs, and that this first separation of closed surfaces was best attained by mouth to mouth aspiration.

The communication was discussed by the President, Dr. Amand Routh, Dr. Eardley Holland, Dr. Russell Andrews, Dr. Handfield Jones and Dr. Herbert Spencer.

Mr. T. G. Stevens read a paper on

Adenomyoma of the Rectovaginal Septum.

The author remarked that the origin of isolated adenomyomata in the rectovaginal septum and elsewhere has received some attention of late, especially with regard to the possibility of the endometrium being the common source.

He described six cases of adenomyoma of the rectovaginal septum, the first of which has already been described before this section of the Royal Society of Medicine in 1909. The other five cases all came under his care in the last six months. In two cases the growth was accidentally discovered in patients who complained of sterility; in the other three the growth was discovered during the performance of hysterectomy.

In all the cases the growth was in the loose tissue just behind the posterior fornix, and except in the first cases was attached to the back of the cervix uteri. In four cases the growth had involved the rectal muscle, and in one of these had penetrated to the submucous tissue of the rectum. In these four cases the peritoneum was closely fixed to the growth. In none of the cases could the symptoms complained of be ascribed to the growth, but were due to some intercurrent uterine lesion. The histology of the growths in every case was the same, namely, that of a diffuse adenomyoma as commonly seen in the body of the uterus.

The diagnosis, prognosis and operative *technique* are discussed.

The origin of the growths may be from :—

(1) The endometrium.
(2) Müllerian remnants.
(3) Wolffian remnants.
(4) The peritoneal endothelium.

The first is proved to be the source of origin of most adenomyomata, but in the case of tumours at a distance from the endometrium any connection between the two is difficult to demonstrate.

The other three possibilities are based on theoretical considerations only, and are incapable of proof.

Dr. W. S. A. Griffith delivered an address on the

Determining Causes of the Fœtal "Lie" in Utero,

a full abstract of which will be found on p. 105.

Hearty votes of thanks were passed to the retiring president and officers on the closing of the present session.